Roots and Intersections on your Calculator (82, 83, 85, 86) NAME:

We will learn how to find x-intercepts (also called roots or zeros) of a single function and how to find intersections of two functions using our calculator. *Remember the italicized questions will be graded. Be sure to answer them fully.*

1. We will graphically solve $0 = 2x^2 - 3x - 10$. This involves, as we have learned, graphing $y = 2x^2 - 3x - 10$ and seeing which x-values make the y-value equal to zero, or equivalently, we're looking for the x-intercepts of this graph.

Use the standard window to graph $y = 2x^2 - 3x - 10$. Notice the graph crosses the x-axis twice. We will find the x-values where this occurs. We'll start with the leftmost (negative) x-intercept.

On the 82 or 83, once on the graph screen, press the **2nd** key, then the **TRACE** key. This opens the **CALCULATE** menu. Select **root** (called **zero** on 83). It will ask for a **lower bound** (or **left bound**). Move the cursor until it is left of the x-intercept, then press **ENTER**. (Remember we are starting with the leftmost or negative root.) It will then ask for an **upper bound** (or **right bound**). Move the cursor to the right of the root and press **ENTER**. It will then ask for a **guess**. Move the cursor to a point that looks like it is near the root itself and press **ENTER**.

On the 85, once on the graph screen, press **MORE**, then select **MATH** from the menu. Then select **ROOT**. All you need to do is move the cursor near the x-intercept and press **ENTER**.

For the 85, sometimes this does not work; it will not give you a root. When this happens, you must define a lower and upper bound, basically an interval of values in which the calculator will look for the root. Let's practice this now. Again from the graph screen, get to the **MATH** menu. This time select **LOWER**. Then move the cursor to the left of the root and press **ENTER**. Then select **UPPER** from the menu. Move the cursor to the right of the root and press **ENTER**. Now select **ROOT**. Move your cursor near the root and press **ENTER**. Your screen should read **ROOT** with a point's coordinates below that. This is an x-intercept on the graph. To get rid of the upper and lower bounds you have just set, simply change the window (**RANGE**) values. When it regraphs on a different window, the bounds will be erased.

On the 86, from the graph screen, press **MORE** to get to **MATH**, and then select **MATH**. Select **ROOT** from this menu. It will ask for a **left bound**. Move the cursor until it is left of the x-intercept, then press **ENTER**. (Remember we are starting with the leftmost or negative root.) It will then ask for a **right bound**. Move the cursor to the right of the root and press **ENTER**. It will then ask for a **guess**. Move the cursor to a point that looks like it is near the root itself and press **ENTER**.

It will calculate the x-value of the x-intercept. *What is the x-value of the negative x-intercept?*

2. Repeat the process to find the value of the other root. Remember for the 82, 83, and 86, the left or lower bound should be left of the root, and the right or upper bound should be right of the root. *What is the x-value of the positive x-intercept?*

3. *So, what are the two solutions to* $0 = 2x^2 - 3x - 10$ *?Copy your graph below with the x-intercepts marked.*

4. Now we will solve $5 = 2x^2 - 3x - 10$. We will do this by graphing $y = 2x^2 - 3x - 10$ and $y = 5$ and seeing where these two graphs intersect. Put both of these relationships into the grapher as $y1 = 2x^2 - 3x - 10$ and $y2 = 5$. You can use the standard window. Notice this adds a horizontal line at the *y*-value of 5 to our graph with which we were working. But remember, we're now looking for where y is 5, or the intersection of these two graphs. Let's find the leftmost intersection first.

On the 82 and 83, enter the **CALCULATE** menu by pressing **2nd** then **TRACE**. Choose **INTERSECT**. It will ask for the **first curve**, **second curve**, and then a **guess**. The first curve is simply the first graph I want to use. Press **ENTER** to select the first curve. (It will automatically select the graph of y1. You press **ENTER** to say you want y1.) The cursor will then switch to the graph of y2. Press **ENTER** to select it. It will then ask for a **guess**. You want to move the cursor near the point of intersection. Press **ENTER** when the cursor is near the leftmost intersection point.

On the 85, press **MORE** to access the **MATH** menu. After selecting **MATH**, then press **MORE** again to find and select the **ISECT** option. It will put a cursor on the screen on the graph of y1 and a little **1** in the upper right corner (to indicate it's on y1). Press **ENTER** to indicate you want to use this y1 graph. Then it puts the cursor on the second graph and a little **2** in the upper right corner. Move the cursor (using the left and right arrows) closer to the intersection we want and press **ENTER** again. You are essentially telling it which two graphs you want the intersection of. It will then calculate the point of intersection.

On the 86, press **MORE** to get to the **MATH** menu. Select **MATH**. Then press **MORE** again to get to the option **ISECT** (stands for intersection). Select this option. It will ask for the **first curve**, **second curve**, and then a **guess**. The first curve is simply the first graph I want to use. Press **ENTER** to select the first curve. (It will automatically select the graph of y1. You press **ENTER** to say you want y1.) The cursor will then switch to the graph of y2. Press **ENTER** to select it. It will then ask for a **guess**. You want to move

the cursor near the point of intersection. Press **ENTER** when the cursor is near the leftmost intersection point.

What is the x-value of this intersection?

5. Repeat the process to find the other intersection point. *What is the x-value of this rightmost intersection?*

6. *So what are the solutions to* $5 = 2x^2 - 3x - 10$ *? Draw the appropriate graph with the intersections labeled.*

7. *Now solve* $15 = 3x^3 + 5x - 3$. *Include an appropriate graph with the solutions to the equation labeled. (Remember the line y = 15 will be outside the range of the standard window, so start with the standard window, but then increase* ***ymax*** *to see the line y = 15.)*